

## CLAIMS

We claim:

1. An apparatus for decurling a running web delivered from a supply roll and fed to a downstream conversion process operating at a line web tension, said

5 apparatus comprising

an upstream brake roll receiving and rotatably engaging the web from the supply roll;

a downstream pull roll receiving and rotatably engaging the web from the brake roll;

10 said brake roll and said pull roll operative to create in the web therebetween a zone of tension greater than the line web tension;

a decurler roll in the web tension zone rotatably engaging the outer face of the web with respect to web orientation on the supply roll; and,

15 a decurler roll adjustment mechanism operative to adjustably position the decurler roll to deflect the web from a normal path of web travel through the web tension zone and to vary the angle of circumferential wrap of the web on the decurler roll.

2. The apparatus as set forth in claim 1 including a rotatable pivot roll mounted in counterrotating relation with the decurler roll to carry the web in the tension zone in engagement with the inner face of the web.

3. The apparatus as set forth in claim 2 wherein the pivot roll has a diameter substantially greater than the diameter of the decurler roll, said pivot roll mounted directly adjacent said decurler roll.

4. The apparatus as set forth in claim 3 wherein the decurler roll adjustment mechanism is operative to move the decurler roll around the circumference of the pivot roll to simultaneously vary the angle of circumferential wrap of the web on the pivot roll and the decurler roll.

5. The apparatus as set forth in claim 4 wherein the adjustment mechanism comprises:

a pair of mounting brackets, each attached at a radial inner end to a pivot shaft rotatably supporting the pivot roll and at a radial outer end to a journaled connection to one axial end of the decurler roll; and,

a drive operatively connected to said pivot shaft to rotate the pivot shaft and mounting brackets and to carry the decurler roll in an orbital path around the circumference of the pivot roll.

6. The apparatus as set forth in claim 2 including an infeed idler roll upstream of the brake roll and an outfeed idler roll downstream of the pull roll.

7. The apparatus as set forth in claim 6 including an intermediate idler roll carrying the web to the pull roll.

8. The apparatus as set forth in claim 7 including a second decurler roll and a second pivot roll positioned downstream of the decurler roll and pivot roll and upstream of the intermediate idler roll, said second decurler roll and second pivot roll oriented to operate on a web delivered from a second supply roll with its outer face inverted from the web delivered from said supply roll.

9. The apparatus as set forth in claim 1 including a brake roll drive operative to retard web movement and a pull roll drive operative to increase web movement.

10. The apparatus as set forth in claim 9 wherein said brake roll drive and pull roll drive are adjustable to selectively vary web tension in the web tension zone.

11. A method for decurling a running web delivered from a supply roll and fed to a downstream conversion process operating at a line web tension, said method comprising the steps of:

(1) creating a zone of increased web tension greater than the line tension downstream of the supply roll and upstream of the process;

(2) positioning a rotatable decurler roll in contact with one face of the web in the zone of increased web tension; and,

(3) adjustably positioning the decurler roll to selectively deflect the web from a normal path of travel through the zone and to vary the amount of circumferential wrap of the web on the decurler roll.

12. The method as set forth in claim 11 wherein the zone of increased tension is created by:

(1) passing the web around a brake roll at an upstream end of the zone;

and,

5 (2) passing the web around a pull roll at a downstream end of the zone.

13. The method as set forth in claim 11 including the steps of:

(1) positioning a rotatable pivot roll in contact with the opposite face of the web immediately adjacent the decurler roll; and,

5 (2) adjusting the position of the decurler roll to simultaneously vary the amount of circumferential wrap of the web on the decurler roll and the pivot roll.

14. The method as set forth in claim 13 wherein the adjusting step comprises moving the decurler roll in an orbital path around the circumference of the pivot roll.

15. The method as set forth in claim 12 including the steps of:

(1) passing the web around an infeed idler roll upstream of the brake roll;

and,

5 (2) passing the web around an outfeed idler roll downstream of the pull roll.

16. The method as set forth in claim 12 including the steps of:

(1) providing separate drives for the brake roll and the pull roll; and,

(2) adjusting said drives to selectively vary web tension in the zone.

17. An apparatus for decurling a running web being delivered from a supply roll and fed to a downstream conversion process operating at a line web tension, said apparatus comprising:

5 a downstream brake roll receiving and rotatably engaging the web from the supply roll;

a downstream pull roll receiving and rotatably engaging the web from the brake roll;

said brake roll and said pull roll operative to create in the web therebetween a zone of web tension greater than the line web tension;

10 a pivot roll in the web tension zone rotatably engaging the inner face of  
the web with respect to web orientation on the supply roll;  
a decurler roll rotatably engaging the outer face of the web with respect to  
web orientation on the supply roll; and,  
an adjustment mechanism operative to move the decurler roll orbitally  
15 around the circumference of the pivot roll and to provide a desired amount of  
circumferential wrap of the web on both the decurler roll and the pivot roll.

18. The apparatus as set forth in claim 17 wherein the decurler roll is  
substantially smaller in diameter than the pivot roll.

19. The apparatus as set forth in claim 18 wherein the ratio of the  
diameters of the decurler roll and the pivot roll is about 1:4.

20. The apparatus as set forth in claim 17 including an infeed idler roll  
for the web upstream of the brake roll and an outfeed idler roll for the web downstream  
of the pull roll, and wherein said infeed roll, brake roll, pivot roll, pull roll and outfeed  
roll are mounted to define a serpentine path of web travel through the apparatus.

21. The apparatus as set forth in claim 17 including a drive motor for  
each of said brake roll and pull roll, said pull roll motor operative to drive the pull roll  
at an overspeed with respect to web speed and said brake roll motor operative to retard  
the brake roll with respect to web speed.

22. The apparatus as set forth in claim 17 including a pull roll motor  
operative to drive the pull roll at a variable overspeed with respect to web speed, and  
means for applying a variable retarding load to the pull roll.

23. An apparatus for decurling a running web delivered from a supply  
roll at an input web tension and fed to a downstream conversion process operating at a  
line web tension, said apparatus comprising:

upstream braking means for receiving and applying a web retarding load  
5 to the web from the supply roll;

downstream pulling means for receiving and applying a web overdrive  
force to the web from the brake roll;

said pulling means and said braking means operative to create in the web therebetween a zone of increased tension greater than the input web tension and the line web tension;

decurling means in the web tension zone for engaging the outer face of the web with respect to web orientation on the supply roll and deflecting the web from a linear path of travel; and

means for controlling said braking means and said pulling means to vary web tension in said tension zone.

24. The apparatus as set forth in claim 23 wherein said controlling means is operable to provide an output line web tension different from the input web tension.

25. A method for decurling a running web delivered from a supply roll at an input web tension and fed to a downstream conversation process operating at a line web tension, said method comprising the steps of:

(1) creating a zone of increased web tension downstream of the supply roll and upstream of the process greater than the input tension and the line tension;

(2) positioning a decurler roll in contact with one face of the web in the zone of increased web tension;

(3) adjustably positioning the decurler roll to selectively deflect the web from a normal path of travel through the zone and to vary the amount of circumferential wrap of the web on the decurler roll; and,

(4) adjusting web tension in the zone of increased tension.

26. The method as set forth in claim 25 wherein said adjusting step comprises overdriving the web at the downstream end of the tension zone and retarding the web at the upstream end of the tension zone.